

Abstracts of Technical Articles from Bell System Sources

*Effects of Rectifiers on System Wave Shape.*¹ P. W. BLYE and H. E. KENT. Operation of mercury arc rectifiers generally results in increased harmonic currents in the rectifier supply circuits and may result in increased harmonic voltages. While these harmonics usually are not serious from the standpoint of the power system, they may result in interference to communication circuits exposed to the power circuits. This paper presents a method of computing these harmonic voltages and currents, and discusses methods of coordinating telephone systems and a-c. power systems supplying rectifiers.

*Joint Use of Poles with 6,900-Volt Lines.*² W. R. BULLARD and D. H. KEYES. A plan has been developed for joint occupancy of poles by power and telephone circuits in the Staten Island, N. Y. area, involving 6,900-volt distribution. The aim of this plan is to secure to the public and to the power and telephone companies over-all safety, convenience, and economy. Results of this cooperative study of joint use are presented in this paper.

*Sound Film Printing—II.*³ J. CRABTREE. The production of sound-film prints from variable density negatives by the Model D Bell & Howell printer has been studied from the point of view of high-frequency response and uniformity of product. The account of this study, begun in Part I, is continued here, with particular reference to the degree of influence of slippage on the high-frequency response, occasioned particularly by non-conformity of the perforation pitch of the negative and positive films. It is found that to improve printing conditions in practice, it is first necessary to achieve consistency in the pitch of the processed negative and positive materials and to make the pitch of the processed negative 0.0004 inch less than that of the positive raw stock.

*The Determination of the Direction of Arrival of Short Radio Waves.*⁴ H. T. FRISS, C. B. FELDMAN, and W. M. SHARPLESS. In this paper are described methods and technique of measuring the direction with

¹ *Elec. Engg.*, January, 1934.

² *Elec. Engg.*, December, 1933.

³ *Jour. S. M. P. E.*, February, 1934.

⁴ *Proc. I. R. E.*, January, 1934.

which short waves arrive at a receiving site. Data on transatlantic stations are presented to illustrate the use of the methods. The methods described include those in which the phase difference between two points constitutes the criterion of direction, and those in which the difference in output of two antennas having contrasting directional patterns determines the direction. The methods are discussed first as applied to the measurement of a single plane wave. Application to the general case in which several fading waves of different directions occur then follows and the difficulties attending this case are discussed.

Measurements made with equipment responsive to either the horizontal or the vertical component of electric field are found to agree.

The transmission of short pulses instead of a steady carrier wave is discussed as a means of resolving the composite wave into components separated in time. More detailed and significant information can be obtained by this resolving method. The use of pulses indicates that (1) the direction of arrival of the components does not change rapidly, and (2) the components of greater delay arrive at the higher angle above the horizontal. The components are confined mainly to the plane of the great circle path containing the transmitting and receiving stations.

A method is described in which the angular spread occupied by the several component waves may be measured without the use of pulses.

Application of highly directional receiving antennas to the problem of improving the quality of radiotelephone circuits is discussed.

*Electron Diffraction and the Imperfection of Crystal Surfaces.*⁵ L. H. GERMER. Bragg reflections are obtained by scattering fast electrons (0.05A) from the etched surfaces of metallic single crystals. The surfaces studied are a (100) face of an iron crystal, (111) face of a nickel crystal and (110) face of a tungsten crystal. In each case the reflections occur accurately at the calculated Bragg positions with no displacement due to refraction. A given reflection is found, however, even when the glancing angle of the primary beam differs considerably from the calculated Bragg value—by over 1.0° in some cases—so that several Bragg orders occur simultaneously. The accuracy with which this glancing angle must be adjusted is a measure of the degree of imperfection of the crystal. From the electron experiments, estimates are made of the widths at half maximum of electron rocking curves. These widths are 0.8° for the iron crystal, 1.5° for the nickel crystal and somewhat over 1.0° for the tungsten crystal. X-ray rocking curves for these same crystals are much narrower, although the observed

⁵ *Phys. Rev.*, December 15, 1933.

widths vary considerably with the treatment of the surfaces. It is concluded that the values obtained from the electron measurements apply to projecting surface metal only, and that *the degree of misalignment is much greater at the surface than deep down within the crystal*. Furthermore, even the x-rays [Mo $K\alpha$ radiation — 0.71A] are not sufficiently penetrating to yield values certainly characteristic of these metal crystals.

*Mutual Impedance of Grounded Wires Lying on the Surface of the Earth when the Conductivity Varies Exponentially with Depth.*⁶ MARION C. GRAY. This paper presents a formula for the mutual impedance of any insulated wires of negligible diameter lying on the surface of the earth and grounded at their end-points, on the assumption that the conductivity of the earth varies exponentially with depth. Various special cases are briefly discussed.

*Signals and Speech in Electrical Communication.*⁷ JOHN MILLS. This book is written by a member of the technical staff of Bell Telephone Laboratories who is well-known for his text on "Radio Communication" (1917) and the more popular presentations of "Within the Atom" (1921) and "Letters of a Radio-Engineer to His Son" (1922). In this book he presents for the general reader a synthesis of the electrical arts of communication in terms of their general fundamental principles. In separate chapters, which are discrete essays in popular and semi-technical language, the fundamental principles of dial operation, transmitters and receivers, loading coils, repeaters, multi-channel or carrier systems, and transoceanic radio-telephony are graphically expounded. The entertaining treatment of engineering achievements in allied fields of the sound picture, broadcasting, television, stereophonic reproduction and the teletypewriter, will intrigue the layman and assist him in acquiring a general understanding of these highly technical developments.

*Some Earth Potential Measurements Being Made in Connection with the International Polar Year.*⁸ G. C. SOUTHWORTH. For several years the Bell System has been studying the relation between radio transmission and earth potential disturbances. A paper dealing with this subject was published in 1931. Prompted by the needs of the International Polar Year, together with the prospect that further work would throw additional light on the nature of radio transmission, the work was extended somewhat in 1932.

⁶ *Physics*, January, 1934.

⁷ Published by Harcourt Brace and Company, New York, N. Y., 1934.

⁸ *Proc. I. R. E.*, December, 1933.

It is expected that useful correlation will be found between the normal earth potential effects which occur day after day during undisturbed periods and the corresponding diurnal and seasonal variation of radio transmission. It seems entirely probable, for instance, that earth potentials are but the terrestrial manifestations of certain changes taking place in the Kennelly-Heaviside layer which may not be found by other methods.

This paper is intended to serve mainly as a progress report outlining briefly the methods and scope of the work and showing the type of data being obtained. It leaves to a later date most of their correlation and their interpretation. The data here presented are in a conventional form used by other investigators for many years. Their value lies mainly in their extent and in the rather wide range of circumstances under which they were obtained.

*Investigation of Rail Impedances.*⁹ HOWARD M. TRUEBLOOD and GEORGE WASCHECK. Measurements of impedance made on five sizes of rails and on two types of bonds are reported in this paper; the investigation covered a range of current per rail of 20 to 900 amperes, and frequencies of 15 to 60 cycles per second. Results are given in a form convenient for engineering use, and include information for applying corrections for bond impedance and for temperature.

⁹ *Elec. Engg.*, December, 1933.